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(12) UK Patent Application (19) GB (11) 2 276 354 (13) A

(43) Date of A Publication 28.09.1994

(21) Application No 9305888.1

(22) Date of Filing 22.03.1993

(51) INT CL[5]
B60R 21/20

(52) UK CL (Edition M)
B7B BSB

(56) Documents Cited
GB 2228235 A EP 0428935 A2 WO 92/17351 A1

(58) Field of Search
UK CL (Edition L) B5A AA3 , B7B BSB
INT CL[5] B60R 21/20 21/22
ONLINE DATABASE: EDOC, WPI

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(54) A cover for a vehicle air-bag

(57) The cover comprises an inner moulding 3 of relatively hard plastics and an outer moulding 4 of soft foam, and is cut to form the "break" line 7 from the inside of the laminate using a laser which does not exert pressure on the cover and thus does not damage the soft foam. Also, by cutting through the hard polymer into the foam, a uniform cut is achieved. Ultra sonic or hot knife cutting may be used.

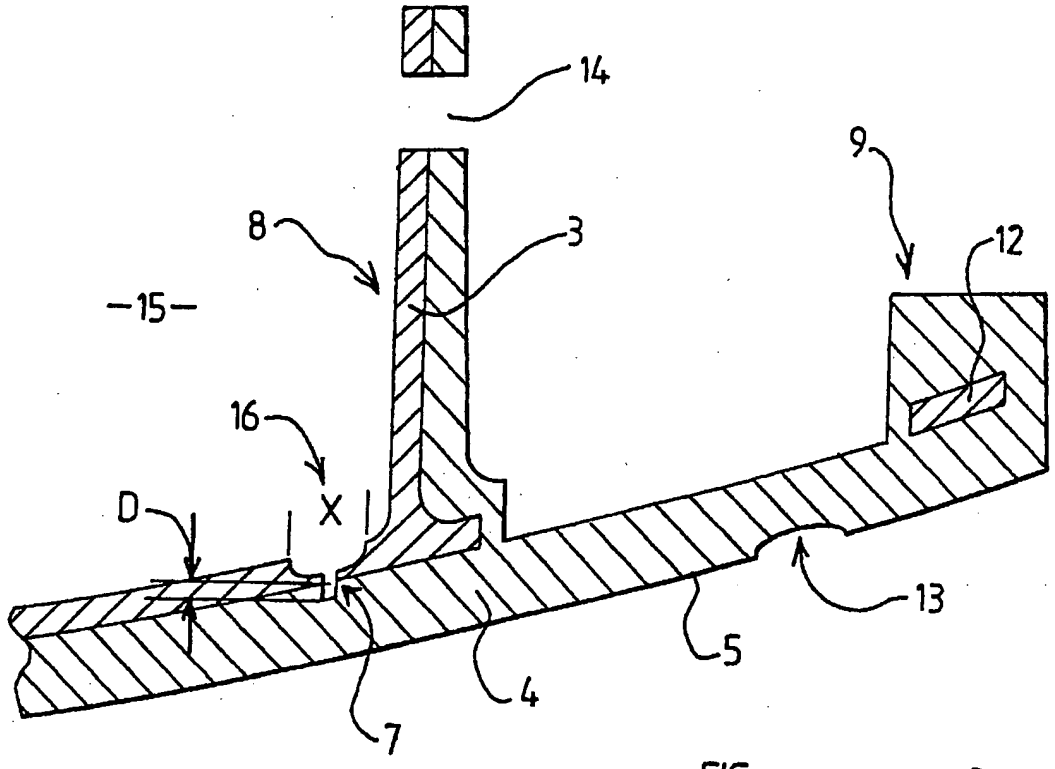

FIG 3

GB 2 276 354 A

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

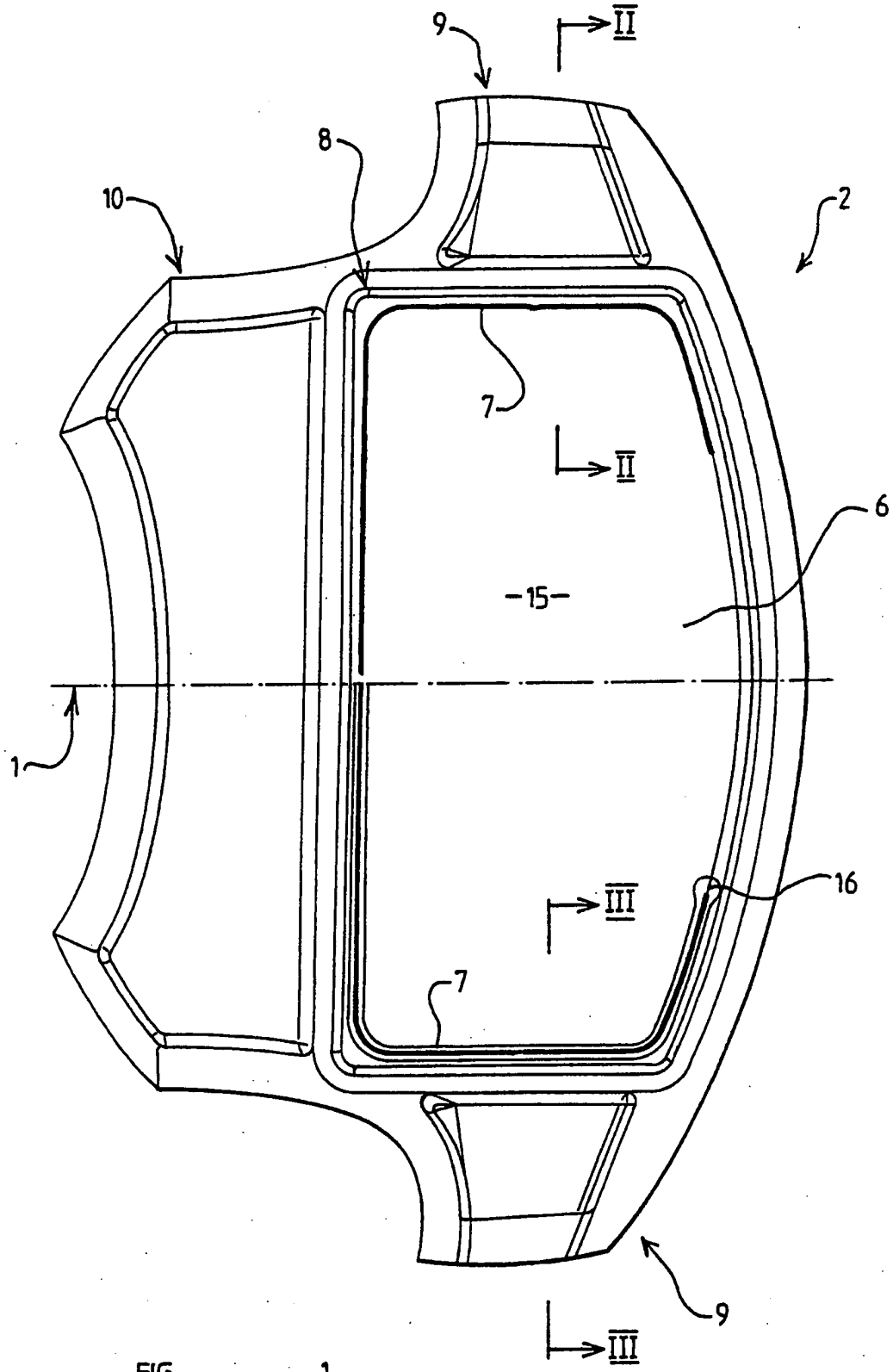

FIG 1

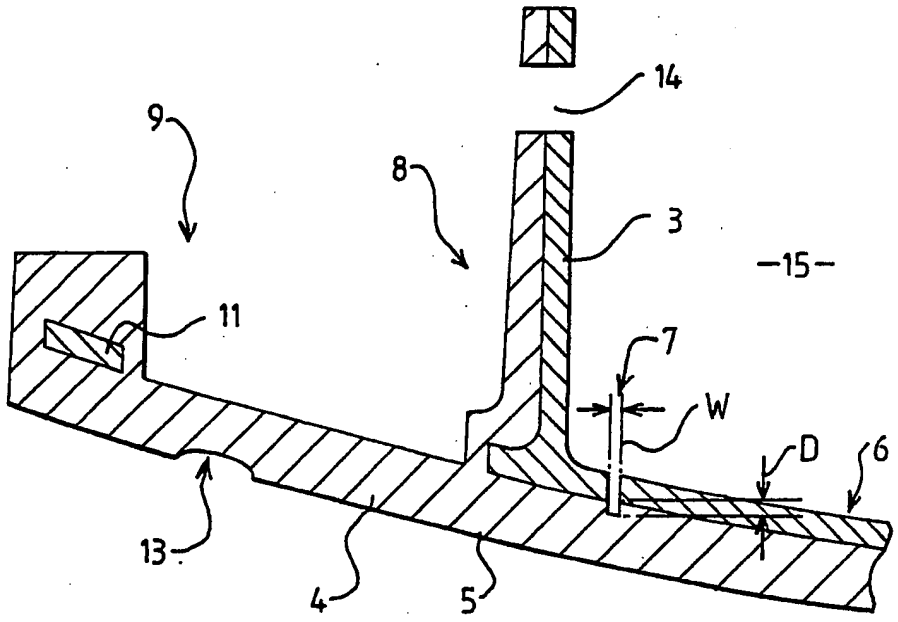

FIG 2

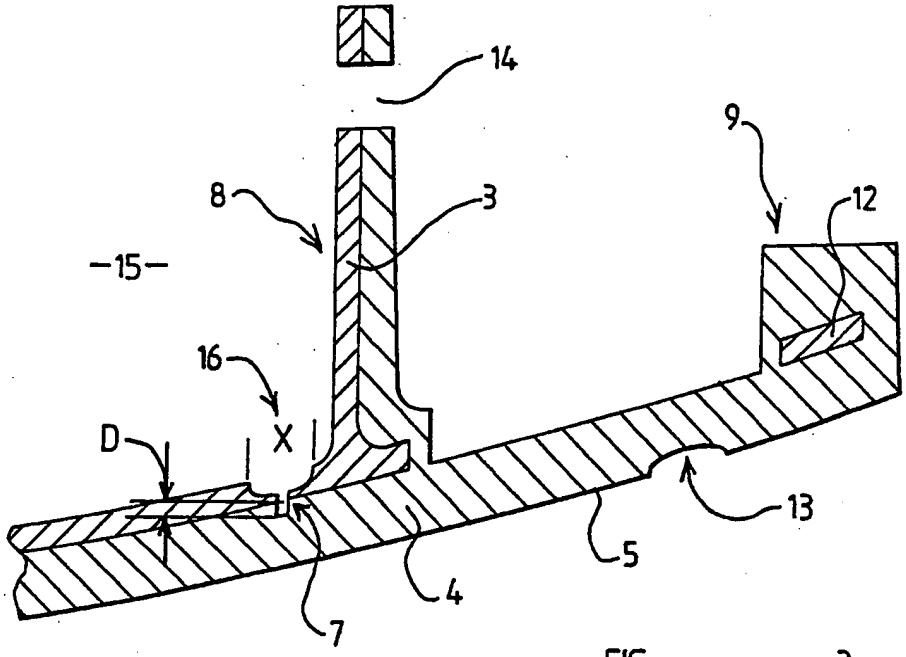

FIG 3

DESCRIPTION OF INVENTION

"IMPROVEMENTS IN OR RELATING TO A COVER FOR AN AIR-BAG"

THE PRESENT INVENTION relates to a cover for an air-bag.

It has been proposed to provide an air-bag in a motor vehicle, the air-bag being adapted to be inflated in the event that an accident should arise, to provide protection for a driver or front-seat passenger in the motor vehicle.

An air-bag may be contained, for example, in the hub of a steering wheel, the hub being provided with a cover which normally protects the air-bag. Alternatively, an air-bag may be mounted in part of the dashboard, that part of the dashboard being provided with a cover which normally protects the air-bag. In each case the cover is usually made of a plastics material, and is provided with one or more "break" lines which are lines of mechanical weakness to enable the cover to break to form an opening when the air-bag is inflated.

US-A-4,120,516 discloses an air-bag cover, where the cover is formed of a laminate, having an outer layer formed of high density polyurethane foam, and an inner layer of low density polyurethane foam which is integral with the outer layer of the laminate. The laminate is cut, from the inside, to form lines of mechanical weakness or break lines.

It is often more desirable to have the cover for an air-bag made from a laminate of which the outer layer is a relatively low density foam, and the inner layer is of high density foam or moulded thermoplastic material. By using such a laminate the cover may have the strength provided by the high density foam or rigid thermoplastic material, and a relatively soft cushioning exterior, formed by the relatively low density foam. The low density foam may have an outer "skin", as is known.

When the cover of US-A-4,120,516 is cut, the cut is made through the low density foam and into the relatively high density foam. The high density foam may be supported on a support surface, so that pressure may be exerted by the cutting blade without any problems arising.

However, if an attempt is made to cut a cover, from the inside, which cover has an inner layer of thermoplastic material or high density foam, and an outer layer of low density foam, the low density foam must be placed upon the support, and when the cover is cut, with a blade which applies pressure, the low density foam becomes compressed. This gives rise to difficulties in performing the cutting operation in an accurate, consistent manner. Also, this technique may create a permanent marking visible on the outer surface of the cover.

Whilst is might be possible to provide a break line simply by forming the layer of thermoplastic material or high density foam with a line or elongate region of relatively thin material, because the material has significant strength, a very strong force may be needed to start breaking the break line. Also, since the

moulding process so that the material has precisely the desired thickness. It may be possible, also, to provide a break line in which the thermoplastic material or the high density foam actually defines a break, there being transverse ribs at spaced apart intervals extending across the break holding the material together. The low density foam may then be moulded to the harder layer. However, if this expedient is adopted the low density foam may well pass through the split line, during the moulding process, lifting the harder layer away from the mould, so that the end product is not satisfactory.

Thus, the present invention seeks to provide an improved method of producing a cover for an air-bag, and a cover produced by the method.

According to this invention there is provided a method of producing an air-bag cover having an inner moulding of relatively hard polymer material and an outer layer of relatively soft polymer material, the method comprising the step of manufacturing the cover and subsequently cutting a break line in the cover, from the inside of the cover, the break line completely penetrating the inner moulding, the cutting being effected utilising a cutting technique that does not exert pressure on the cover.

Preferably the inner moulding is formed of a thermoplastic material.

Alternatively the inner moulding is formed of a high density foam.

Preferably the outer relatively soft polymer layer comprises a layer of low density polymer foam, which may be polyurethane foam.

Conveniently the outer relatively soft polymer layer is provided with an outer skin.

Preferably the cut extends partly into the outer layer.

Conveniently the cut extends into the outer layer by a distance of approximately 1 millimetre.

In one embodiment the inner layer is formed with an area of reduced thickness in the region where the break line is to be cut.

Preferably the outer layer is at least twice as thick as the inner layer.

Conveniently the cut is made by using a laser. One advantage of using a laser is tht the material being cut is vaporised by the laser, and the resultant cut is free from the burrs that would be expected to be present if a mechanical cutter, such as a knife or saw were used. Also, because no knife is present, it is possible to inspect the cut optically during the cutting process.

Alternatively the cut is made by using an ultrasonic knife, or a hot knife.

Preferably the cover is initially produced by first moulding the inner moulding and then subsequently moulding the outer layer to the inner layer before finally cutting the break line.

The invention also relates to a cover for an air-bag whenever produced by a method as described above.

In order that the invention may be more readily understood, and so that further features thereof may be appreciated, the invention will now be described, by way of example, with reference to the accompanying drawings in which:

FIGURE 1 is an underneath view of an air-bag cover in accordance with the invention, adapted to be mounted on a steering wheel, the upper part of the figure illustrating one embodiment and the lower part of the figure illustrating an alternative embodiment,

FIGURE 2 is a sectional view taken on the line II-II of Figure 1, and

FIGURE 3 is a sectional view taken on the line III-III of Figure 1.

Referring to the drawings, Figure 1 illustrates, effectively, two alternative designs of air-bag cover, which designs are very similar. The figure is divided into two parts by a notional horizontally extending line 1. The upper part of the figure illustrates an embodiment in which a cut or break line in a laminate material forming a cover for an air-bag is provided which does not involve any region of "thin" material, whereas the lower part of the figure illustrates an embodiment where an elongate area of thin material is provided in the region of the break line.

However, the remaining features of the two alternative embodiments are substantially identical as can readily be appreciated from the figure.

Referring now to the drawings an air-bag cover 2 is formed from a laminate comprising an inner moulding 3 which may be formed of thermoplastic or dense foam, and an outer layer 4 which is formed of a low density foam, preferably polyurethane foam. The outer layer 4 may be provided with an external skin 5 which can be formed integrally with the foamed layer. The outer layer 4 has a thickness which is at least equal to, and which is preferably greater than, twice the thickness of the inner moulding.

The cover illustrated in Figure 1 is provided with a central region 6, which is substantially surrounded by a break line 7. The region 6 forms the top part of a region of the cover which has a depending wall 8 (the wall 8 is shown in Figures 2 and 3 as extending upwardly, since, in those figures, the cover is inverted, with the "top" surface 5 of the cover being shown at the bottom of the figure. The lower part of the cover is the part of the cover visible in Figure 1).

The cover of Figure 1 is provided with two regions 9 and 10 which project outwardly beyond the wall 8 on opposed sides of the central region 6 and a further region 10 which projects beyond the wall 8 at an edge which forms the lower edge of the central region 6. These regions 9 and 10 are provided so that the cover can be received within a co-operating hub of a steering wheel, the regions 9 and 10 being aligned with "spokes" of the steering wheel. These features are thus features

of design relating only to the particular embodiment illustrated.

It is to be noted, however, that in each of the projecting regions 9 which can be seen in Figures 2 and 3, a part 11,12 of the rigid material or high density foam material forming the cover moulding 3 is provided to support the region 9, and a channel or recess 13 is formed in the outer skin 5 of the layer 4 of low density foam, for design purposes. Also, it is to be noted that the side wall 8 is provided with a through-aperture 14 adapted to co-operate with means to mount an air-bag and a pyrotechnic charge for an air-bag in position in the space 15 which is bounded by the central region 6 of the cover and the side wall 8.

Consideration will now be given to the break line 7 in the region of the cover not provided with any "thin" region of material as shown at the top of Figure 1 and as shown more clearly in Figure 2.

Consideration will now be given to the break line 7 in the portion of the cover, as illustrated, not provided with any region of "thin" material. As can be seen, from the upper part of Figure 1 and from Figure 2, in this part of the cover the break line 7 is formed adjacent the base of the upstanding side wall 8, and is thus formed from the under-side of the cover towards the top of the cover. The break-line is formed by a cut which has a width W approximately 0.3 millimetres. The cut extends through the inner moulding 3 formed of thermoplastic material or high density foam, which layer has a thickness of approximately 2 millimetres, and into the layer of low density foam, which typically has a thickness of 5 millimetres. The cut extends into the low

density foam by a distance of D which is typically approximately 1 millimetre. Since the cut extends into the low density foam it is certain that the cut passes completely through the inner moulding 3. Thus there is no chance that parts of the inner moulding 3 on opposite sides of the break line 7 are still held together.

The cut which constitutes the break line 7 is formed using a cutting technique which does not apply pressure to the cover. Preferably the cut is created using a laser "knife". A laser is used to direct a beam of high intensity light on to the region which is to be cut which vaporises the plastic material in the region of the cut. The vapour may be removed utilising an appropriate vacuum apparatus. It is to be appreciated that by cutting the material utilising a laser knife in this way, no pressure is applied, and thus the layer of low density foam 4 is not compressed in any way. Thus the cut can be made extremely accurately. The cut is burr free and the cut may be optically inspected during the cutting operation.

It is to be appreciated that alternative arrangements may be used instead of a laser knife, which do not apply pressure to the material forming the cover. Thus the cut may be formed using a hot knife. Such a hot knife may comprise an element heated to a temperature such that, when brought into contact with the thermoplastic material or high density foam forming the moulding, and when subsequently brought into contact with the material forming the low density foam layer 4, the material melts. A hot "knife" of this type is preferably formed of an element which is heated electrically to the desired temperature. Again, a vacuum apparatus may be utilised to remove the molten plastic material.

Alternatively again, an ultra-sonic knife may be utilised, comprising an element to which ultra-sonic pulses are provided adapted to cut the plastic material. These techniques may also provide a burr free cut.

Reference will now be made to the portion of the cover shown in Figure 1 provided with the area of thin material, as is shown in Figure 3.

In this embodiment the cover is provided with an area of the moulding 3 formed of rigid thermoplastic material or high density foam, which has a reduced thickness. This area is illustrated as the elongate area 16. It can be appreciated that the region 16 coincides with the position of the break line 7, thus running adjacent the base of the wall 8. The area 16 of reduced thickness has a width X, as shown in Figure 3, which is typically 3 millimetres. The thickness of the moulding formed of thermoplastic material or high density foam 3 is approximately 2 millimetres, and in the region of reduced thickness, the thickness is reduced to approximately 0.5 millimetres. The cut forming the break line 7 is formed in the region of reduced thickness, the cut extending through the rigid moulding 3 of thermoplastic or high density foam and extending into the layer 4 of low density foam by a distance D which is approximately 1 millimetre. Less energy is consumed when cutting through the area 16 of reduced thickness in comparison with that consumed cutting through the unreduced thickness of the moulding 3 (as shown in Figure 2).

It is to be appreciated that in the described cover, the inner layer is preferably formed of a thermoplastic material which is relatively cheap, and the

outer layer is made of a foamed material, such as polyurethane foam, preferably having a thickness which is twice as thick as the thickness of the moulding 3 of thermoplastic material. The cover thus provides a soft exterior, and is relatively cheap. The cover may be produced by first moulding the layer of thermoplastic material or high density foam, and subsequently moulding the foamed layer 4 to the inner moulding 3, and finally cutting the break or split line 7 by one of the techniques described above.

Whilst the invention has been described with reference to a cover specifically adapted to be mounted on a steering wheel, it is to be understood that the invention may equally be applied to a cover to be incorporated in part of a dashboard.

CLAIMS:

1. A method of producing an air-bag cover having an inner moulding of relatively hard polymer material and an outer layer of relatively soft polymer material, the method comprising the step of manufacturing the cover and subsequently cutting a break line in the cover, from the inside of the cover, the break line completely penetrating the inner moulding, the cutting being effected utilising a cutting technique that does not exert pressure on the cover.

2. A method according to Claim 1 wherein the inner moulding is formed of a thermoplastic material.

3. A method according to Claim 1 wherein the inner moulding is formed of a high density foam.

4. A method according to any one of the preceding Claims wherein the outer relatively soft polymer layer comprises a layer of low density polymer foam.

5. A method according to any one of the preceding Claims wherein the outer relatively soft polymer layer is provided with an outer skin.

6. A method according to any one of the preceding Claims wherein the outer layer is made of polyurethane foam.

7. A method according to any one of the preceding Claims wherein the cut extends partly into the outer layer.

8. A method according to Claim 7 wherein the cut extends into the outer layer by a distance of approximately 1 millimetre.

9. A method according to any one of the preceding Claims wherein the inner layer is formed with an area of reduced thickness in the region where the break line is to be cut.

10. A method according to any one of the preceding Claims wherein the outer layer is at least twice as thick as the inner layer.

11. A method according to any one of the preceding Claims wherein the cut is made by using a laser.

12. A method according to any one of Claims 1 to 10 wherein the cut is made by using an ultra-sonic knife.

13. A method according to any one of Claims 1 to 10 wherein the cut is made using a hot knife.

14. A method according to any one of the preceding Claims wherein the cover is initially produced by first moulding the inner moulding and then subsequently moulding the outer layer to the inner layer before finally cutting the break line.

15. A method substantially as herein described with reference to Figures 1 and 2 of the accompanying drawings.

16. A method substantially as herein described with reference to Figures 1 and 3 of the accompanying drawings.

17. A cover for an air-bag whenever produced by a method according to any one of the preceding Claims.

18. Any novel feature or combination of features disclosed herein.

Patents Act 1977
Examiner's report to the Comptroller under Section 17 (The Search Report)

Application number: GB 9305888.1

Relevant Technical fields

(i) UK Cl (Edition L) B7B (BSB) B5A (AA3)

(ii) Int Cl (Edition 5) B60R 21/20, 21/22

Search Examiner

PAT EVERETT

Databases (see over)

(i) UK Patent Office

(ii) ONLINE DATABASE: EDOC, WPI

Date of Search

29 APRIL 1993

Documents considered relevant following a search in respect of claims ALL

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
A	GB 2228235 A (TAKATA)	
A	EP 0428935 A2 (TIP)	
A	WO 9217351 A1 (DAVIDSON TEXTRON)	

Category	Identity of document and relevant passages	Relevant to claim(s)

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